locations on the CCD; operating with a field star five magnitudes brighter than the brightest target stars; operating with spacecraft jitter up to ten times the anticipated amplitude; and simulating the effects of cosmic rays and stellar variability.

The testbed source incorporates all the characteristics of the real sky that are important to the measurements. It produces the same flux as real 9th to 14th magnitude stars, has the same spectral color as the Sun, has the same star density as the Cygnus region of the Milky Way down to stars as faint as 19th magnitude, has several 4th magnitude stars, and has the ability to produce Earth-size transits for selected stars. The camera simulates all the functions to be performed by the space-borne photometer, namely, fast optics, a flight-type CCD, readout without a shutter, a high-speed readout of one megapixel per second, and proto-flight data reduction and analysis software. Piezoelectric transducers are used to provide tip-tilt of the camera to reproduce the motion caused by spacecraft pointing jitter.

To fully demonstrate the concept, transits were created during the testing. Representative transits are shown in figure 1 for 9th (left), 12th (middle), and 14th (right) magnitude stars. The transit depth is given in equivalent Earth size, and the error bars are the one-sigma noise for the data.

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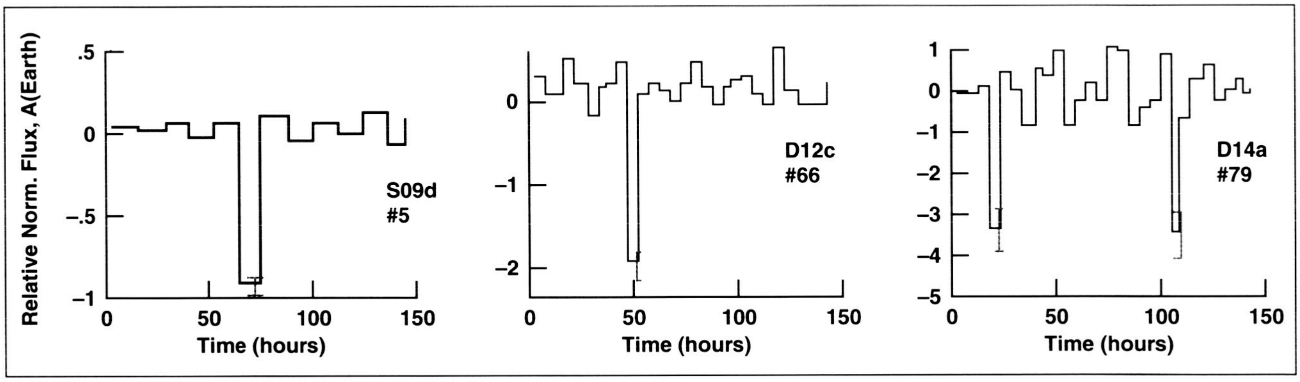

Fig. 1. Simulated transits during the running of the long-duration test with all noise sources.

Minimizing Infrared Stray Light on SOFIA

Allan W. Meyer, Sheldon M. Smith, Chris T. Koerber

The Stratospheric Observatory for Infrared Astronomy (SOFIA) is now being designed and developed, with first light expected in late 2002. Flying at 41,000 feet or higher for 6 hours or more during 120 nights each year, SOFIA will be used for high-resolution observations of celestial objects in the infrared and submillimeter regions, spanning a factor of 1000 in wavelength. In many respects, building SOFIA is a greater challenge than an orbiting observatory would be, but advantages of economy and continuous access make it worthwhile. For work in the infrared, where everything at temperatures above absolute zero can be a source of background interference, the telescope and associated infrared sensors must be carefully designed and constructed to minimize such background. The far-infrared properties of the telescope surfaces, surrounding cavity walls, and surfaces within focal-plane instruments can be significant contributors to background noise. Infrared radiation from sources well off axis, such as the Earth, moon, or aircraft engines, may be multiply scattered by dust on the optics, the cavity walls, and/or surface facets of a complex telescope structure. This report briefly describes recent efforts at Ames Research Center to evaluate some of the infrared properties of the SOFIA telescope surfaces, and also some of the surface treatments that may be used in focal-plane infrared sensors.

In support of progress in the design and development of the SOFIA telescope, the nonspecular reflectometer (NSR) at Ames was reactivated and upgraded, enabling the NSR to be used to measure infrared reflectance properties for samples of planned SOFIA telescope system structural materials and associated surface treatments. Measurements of specular reflectance and bidirectional reflectance distribution functions (BRDFs) were made at wavelengths from 2.2 to 640 microns, at two angles of incidence, and at scattering angles as far as 85 degrees from normal. Samples of planned telescope system materials included carbon fiber reinforced plastic (CFRP), insulating foams, and Nomex fabric. Samples of candidate surface treatments for focal-plane instruments included two commercial surface treatments and several samples prepared at Ames with black paints and other components. The commercial surface treatments investigated were "Optoblack," a paint-like surface treatment from Labsphere, Inc. (North Sutton, New Hampshire), and "Vel-Black," a carbon fiber applique from Energy Science Laboratories, Inc. (San Diego, California). In general, the samples of telescope structural materials appear to have acceptable far-infrared reflectance and scattering properties, even compared to surface treatments expressly developed to minimize such effects. Figure 1 shows specular reflectance results for the telescope samples, compared to infrared-optimized black paints. The commercial surface treatments appear to have excellent characteristics for use in the far infrared. Samples prepared at Ames performed well when silicon carbide grit was mixed in. These Ames-prepared samples approached but did not equal the performance of more carefully developed infrared black paints such as Ames 24E2 and Ball Infrared Black (BIRB).

These empirical results can now be incorporated into a software model of the SOFIA telescope, which would provide predictions of likely infrared background noise levels. However, it appears already possible to conclude from the results of the work described that the surfaces evaluated will probably not contribute significant infrared stray light.

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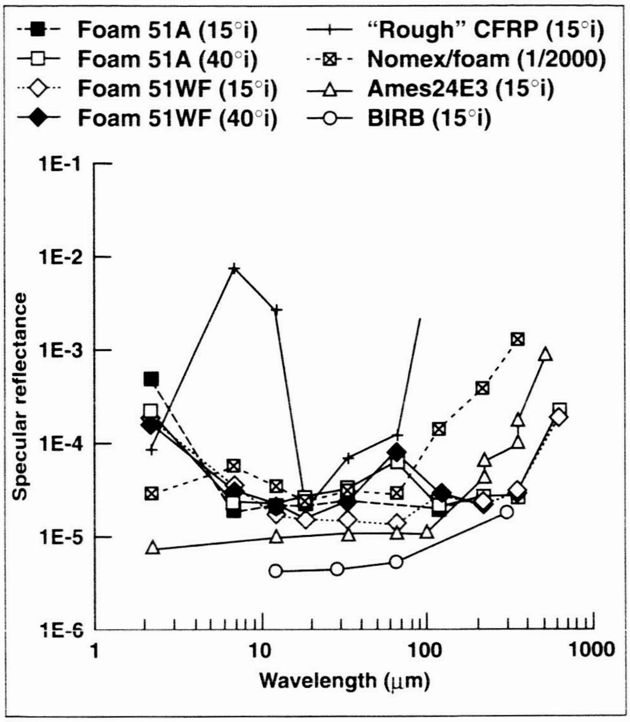

Fig. 1. Surface treatment samples measured by the NASA Ames nonspecular reflectometer, including infrared reflectance spectra for samples of Rohacell white foam, roughened CFRP, Nomex over melamine foam, and, for comparison, previously published data for the black paints Ames 24E2 and BIRB.

Identification of Nitriles in the Interstellar Medium

Yvonne J. Pendleton

The interstellar 4.62-micron band (2165 wavenumber) may be an important contributor to the cyanide (CN) inventory of material available for incorporation into newly forming planetary systems. This band is seen in absorption along lines of sight that pass through icy grains in front of embedded protostars. Therefore, the identification of the interstellar band is important for two reasons: for the astrophysical understanding of organic material in the dense cloud environment, and for the potential relevance to the origin of life, because extraterrestrial